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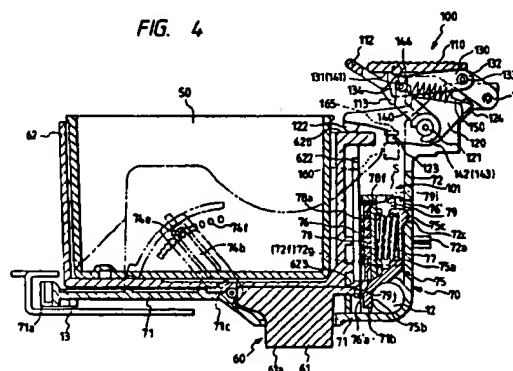
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(54) Ink jet type recording unit, and printer with it

(57) In an ink jet printer, a recording unit (60) in which an ink cartridge 850) is detachably mounted has a cartridge removal preventing member (120, 122) so that the ink cartridge (50) is prevented from being carelessly removed therefrom, and a moving mechanism (101) is provided which, when the recording unit (60) is mounted on a carriage (70), moves a first electrical connecting section (76) towards a second electrical connecting section (622) so that the first and second electrical connecting sections are connected to each other with the aid of an energizing member (77) under pressure, and, when the recording unit (60) is removed from the carriage (70), moves the first electrical connecting section (76) away from the second electrical connecting section (622) against the elastic force of the energizing member (77), whereby the recording unit is detachably mounted on the carriage (70) and the former is positively electrically connected to the latter.



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tridge, but also the ink jet type recording head which results in an increase in printing costs.

In order to overcome the above-described difficulties, an ink jet type recording unit has been proposed in the art in which an ink cartridge accommodating chamber is provided in a frame in which an ink jet type recording head is set, so that the ink cartridge can be readily replaced with another one.

However, the employment of this type of ink jet recording unit gives rise to another problem. That is, when the ink cartridge is replaced with another one, after which the ink jet recording unit is removed from the carriage, air is allowed to enter the recording head during loading or unloading of the ink cartridge. If the recording head including the air is used as it is, then the ink discharging operation becomes unsatisfactory, which makes it impossible to perform or continue the printing operation. Therefore, the object of the present invention is the provision of an improved printer having a detachable ink cartridge, overcoming the prior art deficiencies.

This object is solved by the provision of an ink jet printer according to independent claim 1, and a recording unit according to independent claim 7. Further advantageous features, aspects and details of the invention are evident from the dependent claims, the description and the drawings. The claims are intended to be understood as a first non-limiting approach of defining the invention in general terms.

This invention relates to ink jet type printers, and particularly to an ink jet type recording unit with an ink jet head (hereinafter referred to merely as a "head", when applicable) and the structure of a carriage supporting the ink jet type recording unit, and more particularly to an ink jet type recording unit which has an ink jet type recording head and an ink cartridge as one unit and can be mounted on or demounted from the carriage when required, and to the connection of the ink jet type recording unit with the carriage.

In view of the foregoing, a first aspect of the invention is to provide an ink jet printer in which a recording unit is detachably mounted on the carriage, and the recording unit is positively electrically connected to the carriage.

A second aspect of the invention is to provide an ink jet type recording unit in which, when removal of the bubbles therefrom is impossible, replacement of its ink cartridge is prevented.

(1) The first aspect of the invention has been achieved by the provision of an ink jet printer which, according to one aspect of the invention, comprises:

an ink jet type recording head for jetting printing ink towards a printing sheet to print given data thereon;

a carriage on which the ink jet type recording head is detachably mounted;

a substantially flat-plate-shaped first electrical connecting section provided on the carriage;

a substantially flat-plate-shaped second electrical connecting section provided on the ink jet type recording unit, so as to be connected to the first

electrical connecting section under pressure;

an energizing member adapted to connect the first electrical connecting section to the second electrical connecting section under pressure; and

a unit moving mechanism which,

when the ink jet type recording unit is mounted on the carriage, moves the first electrical connecting section towards the second electrical connecting section so that the first and second electrical connecting sections are connected to each other under pressure by the energizing member, and

when the ink jet type recording unit is removed from the carriage, moves the first electrical connecting section away from the second electrical connecting section against the elastic force of the energizing member.

It is preferable that, in the ink jet printer, the first electrical connecting section comprises one end portion of an FPC the other end portion of which is connected to a control section in a printer body, and the unit moving mechanism has a pad made of an elastic material which is arranged behind the first electrical connecting section so that the first electrical connecting section is connected to the second electrical connecting section under pressure through the pad.

Furthermore, it is preferable that, in the ink jet printer, the unit moving mechanism has a flat-plate portion which supports the pad and is moved back and forth with respect to the second electrical connecting section, the flat-plate portion supporting the pad in such a manner that the pad is slightly movable in a direction perpendicular to the direction in which the flat-plate portion is moved back and forth.

Moreover, it is preferable that the ink jet printer further comprises: a mounting mechanism which, when the ink jet type recording unit is mounted on the carriage, fastens the ink jet type recording unit to the carriage, and when the ink jet type recording unit is removed from carriage, unfastens the ink jet type recording unit from the carriage, the mounting mechanism operating in association with the unit moving mechanism.

(2) The second aspect of the invention has been achieved by the provision of an ink jet type recording unit which, according to another aspect of the invention, comprises:

a casing which can be detachably mounted on a carriage and has an ink cartridge accommodating chamber;

an ink jet type recording head which, when the casing is mounted on the carriage, is fixed at a position where the ink jet recording head is confronted with a platen;

a circuit board in which circuit means for driving the recording head is built, and which has contacts which are connected to contacts provided on a recording apparatus body,

the circuit board being connected through a

FIG. 4 is a sectional view taken along line IV-IV in FIG. 2;

FIGs. 5(a) and 5(b) are a plan view and a front view showing a play preventing member;

FIG. 5(c) is a sectional view taken along line c-c in FIG. 5(b);

FIGs. 6(a), 6(b) and 6(c) are a plan view, a front view, and a left side view of a pad holder in the printer, respectively;

FIGs. 6(d) and 6(e) are sectional views taken along line d-d and line e-e in FIG. 6(b), respectively;

FIGs. 7(a), 7(b) and 7(d) are a plan view, a front view, and a rear view of a pad, respectively;

FIG. 7(c) is a sectional view taken along line c-c in FIG. 7(b);

FIG. 7(e) is an enlarged diagram showing part of FIG. 7(c);

FIG. 8 shows a plate cam. More specifically, FIGs. 8(a) and 8(c) are a front view and a rear view of the plate cam, respectively, FIG. 8(b) is a sectional view taken along line b-b in FIG. 8(c), FIG. 8(d) is a right side view with FIG. 8(c) as a front view, and FIG. 8(e) is a bottom view;

FIGs. 9 and 10 are explanatory diagrams for a description of the operation of a unit moving mechanism;

FIG. 11 is a diagram showing essential parts of the internal structure of a printer to which an ink jet type recording unit according to the invention is applied; FIG. 12 is a top view of an example of a color printing ink jet type recording unit according to the invention; FIG. 13 is a sectional view taken along line 13-13 in FIG. 12;

FIG. 14 is a sectional view taken along line 14-14 in FIG. 12;

FIG. 15 is an exploded perspective view of the color printing ink jet type recording unit according to the invention;

FIG. 16 is a diagram showing the structure of the bottom of the above-described recording unit;

FIG. 17 is a diagram showing part of a head casing with a flexible cable;

FIG. 18 is a sectional view of a tongue-shaped piece of a flexible cable;

FIGs. 19(a) and 19(b) are diagrams showing an example of a circuit board mounted on a recording unit;

FIGs. 20(a) and 20(b) are a plan view and a sectional view, respectively, showing the arrangement of ink supplying needles and their relevant components in a head casing;

FIG. 21 is a perspective view showing an example of a monochromatic printing ink jet type recording unit according to the invention;

FIG. 22 is a diagram of the mounting procedure of the recording unit on the carriage;

FIG. 23 is a perspective view showing the position of an ink cartridge locking member in the case where

an ink cartridge is loaded with the recording unit mounted on the carriage;

FIG. 24 is a sectional view showing the connection of the ink cartridge and the recording unit under the condition that the ink cartridge locking member inhibits the loading and unloading of the ink cartridge;

FIGs. 25(a) and 25(b) are diagrams showing the recording units removed from the carriage wherein the loading and unloading of the ink cartridge is inhibited by the ink cartridge locking member;

FIG. 26 is a plan view showing another example of the ink cartridge locking member;

FIG. 27 is a sectional view taken along line 27-27 in FIG. 26; and

FIG. 28 is an explanatory diagram for a description of a prior art relevant to the invention.

Preferred embodiments of the invention will be described with reference to the accompanying drawings.

FIG. 1 is a sectional side view showing the internal structure of an example of an ink jet printer according to the invention, and FIG. 11 is a perspective view showing essential parts of the internal structure of the printer.

First, the arrangement of the ink jet printer will be outlined.

Mainly in FIG. 1, reference numeral 10 designates a printer body; 11, a printer body casing; and 20, an automatic sheet supplying device built in the printer body 10.

In the printer body 10, what are provided along a sheet conveying path PP on which a printing sheet P (not shown) supplied from the automatic sheet supplying device 20 is conveyed, are a sheet conveying roller 30, a pinch roller 40 pressed against the roller 30 so as to be driven by the latter 30, a regulating member (or a platen) 41 for guiding the rear surface of the printing sheet, a carriage 70 on which an ink jet type recording unit 60 (hereinafter referred to as "a recording unit 60" or merely as "a unit 60", when applicable) is mounted which has an ink jet type head section 61 adapted to jet printing ink onto a printing sheet, a guide roller 80, a pair of sheet discharging rollers 81 and 82, and a sheet discharging section 90. A sheet discharging tray 91 is provided in front of the printer body 10 so that sheets discharged from the printer body are stacked on it.

A printing sheet P supplied from the automatic sheet supplying device 20 is conveyed along the sheet conveying path PP, which is curved downwardly as a whole, to the sheet conveying roller 30, where it is regulated in the angle of conveyance by the pinch roller 40. The sheet P thus regulated is further conveyed on. Thereafter, the front end portion of the sheet P is guided by the regulating member 41 which serves also as a guide member, so that a predetermined distance is provided between the sheet and the ink jet head section 61. Under this condition, the latter 61 jets printing ink onto the printing sheet P to print given data on the latter P. In FIG. 1, reference character A designates a printing region. The sheet thus printed is moved onto the sheet discharging tray 91 by

portion of the FPC 76' is connected to the control section of the printer body 10.

As shown in FIG. 6, the pad holder 79 has a pair of rectangular holes 79d on both sides of the flat plate portion 79a, and a pair of protrusions 79e which are extended in the rectangular holes 79d, respectively. The above-described hooks 75d of the play preventing member 75 are inserted into those rectangular holes 79d until they are engaged with the protrusions 79e, respectively, so that the pad holder 79 and the play preventing member 75 are temporarily locked to each other.

The pad holder 79 has a positioning rectangular hole 79f below the left rectangular hole 79d, and a positioning X-shaped hole 79g below the right rectangular hole 79d. The positioning rectangular hole 79f is slightly elongated horizontally. As shown in FIGS. 2 and 4, quadrangular-prism-like pieces 72f and 72g extended forwardly from the rear board 72 are inserted into the aforementioned positioning holes 79f and 79g, respectively. That is, the pad holder 79 is positioned vertically with the quadrangular-prism-like piece 72f engaged with the rectangular hole 79f, and it is positioned vertically and horizontally with the quadrangular-prism-like piece 72g engaged with the X-shaped hole 79g, and it is movable back and forth (right and left in FIG. 4) being guided by those quadrangular prisms 72f and 72g.

The pad holder 79 further includes right and left side boards 79h and 79i. Each of the side boards 79h has upper and lower pins 79j in such a manner that those pins 79j are abutted against the cam surface of the plate cam 160 (described below).

The plate cam 160 is as shown in FIG. 8. FIG. 8(a) is a front view of the plate cam; FIG. 8(b) is a sectional side view of the plate cam (or a sectional view taken along line b-b in FIG. 8(c); FIG. 8(c) is a rear view of the plate cam; and FIG. 8(d) is a right side view of the plate.

The plate cam 160 includes a horizontal member 161, and a pair of vertical members 162 and 162 which are extended downwardly from both ends of the horizontal member; that is, it is substantially U-shaped, embracing the pad holder 79 (cf. FIG. 2).

Each of the vertical members 162 has upper and lower pins 163 on its outer edge. Those pins 163 of the vertical members 162, as shown in FIGS. 2 and 9, are engaged with elongated holes g formed in the side boards 73 and 74. With the pins 163 being guided by the elongated holes g, the plate cam 160 is vertically movable. The sliding portions of the pins 163 which are brought into slide contact with the elongated holes g are flattened to increase their wear-resistance.

Each of the vertical members 162 and 162 has upper and lower cam surfaces 164 and 164 in its rear surface, in such a manner that the pins 79j of the pad holder 79 are abutted against those cam surfaces 164, respectively. Each of the cam surfaces 164 is made up of an inclined surface 164a and a vertical surface 164b (which is parallel with the direction of movement of the plate cam). In each of the upper cam surfaces 164, a clicking protrusion is formed along the border line

between the inclined surface 164a and the vertical surface 164b so that the respective pin is clicked when operated. The four inclined surfaces 164a are all equal in the angle of inclination to one another; that is, they are all in parallel with one another.

A locking piece 165 is extended from the upper edge of the horizontal member 161. The locking piece 165 is coupled to a hook-shaped coupling portion 123 of the mounting mechanism 100 (described later), so that the vertical motion of the plate cam 160 is effected in association with the operation of the mounting mechanism 100.

As shown in FIG. 4, the ink jet type recording unit 60 includes the aforementioned head section 61, and a casing 62.

The recording unit 60 shown in FIG. 4 is a full-color printing unit. As shown in FIG. 3(b) a red ink jetting nozzle array NR, a yellow ink jetting nozzle array NY, and a blue ink jetting nozzle array NB are provided on the lower surface of the head section 61, namely, a nozzle surface 61a which confronts with the printing sheet. Each of the arrays is made up of twenty-four (24) nozzles n which are arranged in two lines (twelve nozzles per line). That is, the nozzle surface 61a has seventy-two nozzles n.

The casing 62 accommodates an ink cartridge 50 (as described later). A lever and other components (described later) are provided for the casing 62, to fix the ink cartridge 50. The ink cartridge 50 is divided into three ink chambers which are filled with a red ink, a yellow ink, and a blue ink, respectively.

Three needles 615, 616 and 617 (see FIG. 3(a)) with flow paths are provided on the upper surface of the head section 61. When the ink cartridge 50 is set in the casing 62, the needles 615, 616 and 617 are inserted into the respective ink chambers of the ink cartridge 50, so that the red, yellow and blue inks are supplied through the flow paths to the nozzle arrays NR, NY and NB, respectively.

Nozzle driving elements are built in the head section 61. Those nozzle driving elements are selectively activated to cause the respective nozzles to jet ink droplets onto the printing sheet thereby to form the given image on the latter.

A second electrical connecting section 622 is provided on the rear surface of the casing 62. The second electrical connecting section 622 is made up of a substrate. A plurality of contacts are formed on the surface of the substrate so that they are connected to the contacts 76b of the first electrical connecting section 76 under pressure. The substrate is connected through an FPC 623 to the above-described nozzle driving elements. The arrangement of the second electrical connecting section 622 will be described later in more detail.

In the ink jet printer, the nozzles must be positioned with high accuracy. Hence, the positioning of the nozzles is carried out with the head section 61. For this purpose, the head section 61 is not integral with the casing 62, and it is formed with much higher tolerances than the latter 62.

the compression spring 77, so that the sliding portions 75b and 75c are abutted against the guide shaft 12.

The unit 60 is removed from the carriage as follows: The knob 112 of the operating lever 110 is turned clockwise in FIG. 4. As a result, the knob 112 is elastically deformed, thus being turned with respect to the operating lever. Hence, the hook 113 is disengaged from the end portion 134 of the first link 130, and the operating lever 110 is turned. In association with the rotation of the operating lever 110, the unit pressing lever 120 is turned. Hence, the unit 60 can be removed from the carriage.

As the unit pressing lever 120 is turned in the above-described manner, as shown in FIG. 10 the plate cam 160 is moved upwardly, so that the cam surfaces 164 abut against the pins 79i of the pad holder 79, thus pushing the pins 79i to the right in FIG. 10. As a result, the pad holder 79 is moved to the right in FIG. 4 against the elastic force of the compression spring 77. In this operation, since the inclined surfaces 164a of the cam surfaces 164 are equal in the angle of inclination to one another, the pad holder 79 is retracted in the direction which is perpendicular to the contact surfaces of the first and second electrical connecting sections 76 and 622 while maintaining those electrical connecting sections in parallel with each other.

Hence, in removing the unit 60, the first electrical connecting section 76 on the side of the carriage, and the second electrical connecting section 622 on the side of the unit 60 are loosened from each other. Therefore, in this case, those electrical connecting sections 76 and 622 are prevented from being roughly rubbed by each other, or from being damaged.

In the case where, under the condition shown in FIG. 10, the unit 60 is mounted again, the pad holder 79 has been retracted to the right. Hence, the unit 60 can be smoothly and readily mounted on the carriage 70, with the first and second electrical connecting sections 76 and 622 not being rubbed by each other. Thereafter, the operating lever 110 is turned. As a result, the unit pressing lever 120 is also turned to fix the unit 60, and the hook 113 is engaged with the end portion 134 of the first link 130, whereby the unit is fixedly secured thereto.

As the unit pressing lever 120 is turned, the plate cam 160 is moved downwardly, so that its cam surfaces 164 are disengaged from the pins 79i of the pad holder 79. Hence, the pad holder 79 pushes the first electrical connecting section 76 against the second electrical connecting section 622 of the unit 60 through the pad 78 with the aid of the compression spring 77. In the case where the cam surfaces 164 of the plate cam 160 are disengaged from the pins 79i of the pad holder 79 as was described above, the pins 79i are caused to slide down the inclined surfaces 164a. Hence, the pad holder 79 gradually pushes the first electrical connecting section 76 against the second electrical connecting section 622 while maintaining those electrical connecting sections parallel with each other. Thus, the mounting of the unit 60 is free from a difficulty that, for instance, the menis-

cuses formed at the ends of the nozzles of the head section 61 are broken by impact.

The unit 60 will be described in more detail.

As was described above, the ink jet type recording unit 60 is detachably mounted on the carriage 70. An ink jet type recording unit 60 to be mounted thereon is selected according to whether a monochromatic printing operation is carried out or whether a color printing operation is carried out. The ink jet type recording unit 60 mounted on the carriage 70 receives drive signals through the FPC 76 which has its one end connected to recording head driving means (not shown), and the other end secured to the carriage 70.

In FIG. 11, reference numeral 19 designates capping means for sealing the recording head when the printer is not in use.

FIGS. 12 through 15 show an example of the ink jet type recording unit 60, which constitutes one of the specific features of the invention. In those figures, reference numeral 62 designates a casing which forms a recording unit body. The casing 62 is a container which provides an ink cartridge accommodating chamber 611 adapted to accommodate an ink cartridge 50. An ink jet type recording head 612 is provided on the bottom of the casing which is opposite to a member 640. The casing has a window 610b in its wall (the front wall 610d in the embodiment) so that the quantity of ink in the ink cartridge 50 can be visually detected.

The casing 62 has an ink cartridge fixing lever 613 along its one upper edge. The lever 613 is used to push the ink cartridge 50 into the ink cartridge accommodating chamber 611, to fix the ink cartridge 50 in the chamber 611, and to pull the ink cartridge 50 out of the chamber 611.

The end portion (on the side of the timing belt 17) of the ink cartridge fixing lever 613 is coupled to the casing 62 through a pair of shafts 614 and 614, so that the lever 613 is coupled to the casing 62 to be swingable about the shafts 614 and 614. In addition, the lever 613 has a pair of side pieces 613a on its both sides which cover two opposite side walls of the casing 62.

The side pieces 613a have engaging holes 613b, respectively. The two opposite side walls of the casing 62 have locking pieces 610a in correspondence to the engaging holes 613b of the side pieces 613a so as to prevent the ink cartridge fixing lever 613 from opening due to vibrations or the like.

Ink supplying needles 615, 616 and 617 are embedded in the bottom of the head section 61 which are inserted into the ink supplying outlets 55 of the ink cartridge 50, whereby inks are supplied to the recording head 612 through flow paths 618, 619 and 610 provided in a head casing 621 (described later).

The recording unit has a circuit board 622 on its one side which becomes the rear side when the recording unit is mounted on the carriage 70 (or on its right side in FIG. 13). The circuit board 622 has a drive circuit for driving the recording head 612, and it is connected to the latter 612 through an FPC 623.

ribs 638 are abutted against the bottom of the ink cartridge 50, thus positioning the latter 50. As was described above, the side surfaces of the ribs are in smooth contact with the wall 621c, and the upper ends 638a are located below the frame 621a. This feature prevents the ink from rising by capillary action.

Referring back to FIGS. 12 through 15, reference numeral 640 designates an ink cartridge locking member mounted on an upper end portion 610c of the casing 62. The latter 640 has a protruded piece 641 which is substantially flush with the upper surface of the ink cartridge, and a spirally inclined surface 642 which is confronted with the protrusion 122 of the unit pressing lever 120 (FIG. 22) of the unit mounting mechanism 100. The protruded piece 641 is kept urged towards the ink cartridge 50 by a torsion coil spring 643.

The protruded piece 641 of the ink cartridge locking member has an end portion 641a whose thickness is so determined that it can be fitted in a groove 51 formed in the outer surface of the ink cartridge 50. And the height of the protruded piece 641 is so determined that, when the protruded piece 641 is abutted against the rib 52 of the ink cartridge 50, the ink supplying needles 615, 616 and 617 are spaced from the ink supplying outlets 55. Hence, the printer is free from the difficulty that the seals 56 of the ink supplying outlets 55 are damaged by the careless insertion of the ink cartridge 50 into the casing 62.

The above-described recording unit is for a color printing operation. The monochromatic printing recording unit is substantially equal in construction to the color printing recording unit. In the case of the monochromatic printing recording unit, the ink cartridge may be decreased in size. In this case, as shown in FIG. 21, a protrusion 649 is formed on the bottom of a casing 62' so as to fill the gap between the carriage 70 and the casing 62' thereby to set the latter in place.

When, in the embodiment thus designed, the operating lever 110 is turned in the direction of the arrow C as shown in FIG. 22 with the casing 62 of the recording unit 60 positioned on the carriage 70, then the unit pressing lever 120 is turned about the shaft 121, so that the protrusion 122 of the unit pressing lever 120 is moved down the spirally inclined surface 642 of the ink cartridge locking member 640 which is on the locus of the protrusion 122, while pressing the spirally inclined surface 642. As a result, the ink cartridge locking member 640 is turned about 60° against the elastic force of the torsion coil spring 643; that is, the protruded piece 641 is retracted from the ink cartridge accommodating chamber 611 (to the position indicated by the dotted line in FIG. 12). As was described before, when the operating lever 110 is turned, it is held turned by the elastic force of the spring 150.

On the other hand, as the operating lever 110 is turned, the first electrical connecting section 76 of the carriage 70 is protruded towards the casing 62 as was described before, thus being brought into contact with the contact patterns 635, 635, 635,.... of the circuit board

622. As a result, the circuit board 622 of the unit 60 is connected through the flexible cable 76 to the control means of the printer body.

Thus, the unit can be operated with the drive voltage which has been set by the patterns 637a through 637d of the circuit board 622. And it is determined from the conductive pattern 637e whether a monochromatic printing recording unit is loaded or whether a color printing recording unit is loaded.

Under this condition, the locking pieces 610a are disengaged from the engaging holes 613b, and then the ink cartridge fixing lever 613 is pulled upwardly, so that the ink cartridge accommodating chamber 611 is opened upwardly. When, under this condition, the ink cartridge 50 is inserted into the ink cartridge accommodating chamber 622, the side ribs 53 and 53 of the ink cartridge 50 are engaged with the front protrusions 613c of the ink cartridge fixing lever 613. That is, the ink cartridge 50 is supported by the protrusions 613c and the front wall 610d of the casing, thus being spaced from the ink supplying needles 615 through 617.

Under this condition, the lever 613 is pushed downwardly. In this case, the protruded piece 641 of the ink cartridge locking member 640 has been retracted from the cartridge accommodating chamber 611. Therefore, as the lever 613 is moved downwardly, the ink cartridge 50 is pushed downwardly so that, as shown in FIG. 24 the ink supplying needles 615, 616 and 617 are engaged with the ink supplying outlets 55 while breaking the seals 56 of the latter 55. (FIG. 24 shows the protruded piece 641 which is protruded towards the accommodating chamber 611 with the recording unit unloaded from the carriage.)

At the same time, the ink cartridge detecting piece 625, being elastically pushed towards the circuit board 622 by the ink cartridge 50, is brought into contact with the detecting patterns 632, so that the loading of the ink cartridge 50 is detected.

In the case where the ink in the ink cartridge 50 is used up by printing, the ink cartridge fixing lever 613 is turned by raising its one end portion with the recording unit 60 held on the carriage 70, so that the side ribs 53 and 53 of the ink cartridge 50 are engaged with the protrusions 613c of the lever 613. Hence, the ink cartridge 50 is pulled upwardly by turning the lever 613, thus being disengaged from the ink supplying needles 615, 616 and 617.

With the lever 613 pulled up to its top dead point, the ink cartridge 50 is removed out of the casing. Thereafter, a new ink cartridge 50 is inserted into the casing. In this case, the ink cartridge locking member 640 has been turned about 60°; that is, its protruded piece 641 has been retracted from the ink cartridge accommodating chamber 611 (as indicated by the dotted line in FIG. 12). Therefore, the ink cartridge 50 is set by pushing the lever 613 downwardly.

When the old ink cartridge 50 is removed from the casing, the ink cartridge detecting piece 625 is disengaged from the detecting patterns 632; and when the

622 are more uniformly connected to each other. The protrusions 78a of the pad 78 have the holes 78d, thus being deformable. Hence, the pad 78 follows the contacts of the first electrical connecting section 76 smoothly, which contributes to the uniform connection of the first and second electrical connecting sections.

(iv) The moving mechanism 101 has the flat-plate portion 79a which supports the pad 78 and is moved back and forth with respect to the second electrical connecting section. The flat-plate portion 79a supports the pad 78 in such a manner that the pad is slightly movable in the direction perpendicular to the direction in which the flat-plate portion is moved back and forth (or in the direction which is in parallel with the flat-plate portion). Hence, the first and second electrical connecting sections 76 and 622 are more uniformly connected to each other.

That is, the pad 78 is finely movable since it is elastically deformable. In addition, as was described above, the pad 78 is so supported that it is slightly movable in the direction perpendicular to the direction in which the flat-plate portion 79a is moved back and forth. Therefore, the pad thus supported is finely movable as a whole. Hence, when the first electrical connecting section 76 is pushed against the second electrical connecting section 622, the pad 78 located behind the first electrical connecting section 76 is finely moved.

This fine movement contributes to the more uniform connection of the first and second electrical connecting sections 76 and 622.

In the above-described embodiment, the pad 78 has the protrusions 78a which press the contacts 76b of the first electrical connecting section 76 from behind. The protrusions 78a are suitably positioned behind the contacts 76b because the pad 78 is finely moved as was described above. As a result, the first and second electrical connecting sections are more suitably connected to each other.

(v) The mounting mechanism 100 of the head is operated in association with the moving mechanism 101. Hence, the recording unit 60 can be more readily mounted on the carriage 70 or removed therefrom.

(vi) The guide shaft 12 and the carriage 70 are pushed against each other by the energizing member 77; that is, the former 12 and the latter 70 are snugly engaged with each other. Hence, the ink jet printer is able to provide printed sheets which are improved in quality.

The energizing member 77, which pushes the guide shaft 12 and the carriage 70 against each other, further pushes the first and second electrical connecting sections 76 and 622 against each other. This means that, in the ink jet printer, the number of energizing members is reduced.

Hence, if summarized, in the ink jet printer, the number of components is small, and the recording

unit 60 is detachably mounted on the carriage 70, and the former 60 is positively electrically connected to the latter 70, and furthermore, the carriage 70 and the guide shaft 120 are engaged with each other without looseness.

(vii) The ink jet type recording unit 60 has a plurality of nozzle arrays arranged in the direction of movement of the carriage 70. Hence, the resultant print is high in resolution.

As was described above, the recording unit 60 has a plurality of nozzle arrays arranged in the direction of movement of the carriage 70. Hence, if the forward and backward movements of the carriage are unstable because of its looseness, then the resultant print is low in quality. However, in the ink jet printer of the invention, the guide shaft 12 and the carriage 70 are pushed against each other by the energizing member 77, so that there is no play between the guide shaft 12 and the carriage 70, as was described above. Hence, the resultant print is high in quality.

(viii) The ink jet printer has the monochromatic printing ink jet type recording unit 60' and the color printing ink jet type recording unit 60. With the monochromatic printing ink jet type recording unit 60' loaded in the printer, a monochromatic printing operation is carried out; and with the color printing ink jet type recording unit 60 loaded in the printer, a color printing operation is carried out.

In a color printing operation, especially in a full-color printing operation, it is necessary for the printing head to jet a red ink, a yellow ink, and a blue ink. Therefore, the color printing ink jet type recording unit 60 of the invention has three nozzle arrays NR, NY and NB, each of which has two lines of nozzles (six lines of nozzles in total).

In addition, the energizing member 77 permitting the replacement of the head is also used as play preventing means, which contributes to miniaturization of the ink jet printer.

That is, a small printer can be formed according to the invention which is able to perform both a monochromatic printing operation and a color printing operation high with high picture quality.

(ix) The carriage 70 has the positioning portions 71f and 74d which determine the mounting position of the ink jet type recording unit 60 (or 60'). The recording unit 60 (or 60') is urged towards the positioning portions 71f and 74d by the energizing member. Hence, the recording unit 60 is positioned in place at all times, and the resultant print is therefore high in quality.

The energizing member may be the above-described one 77, which contributes to miniaturization of the carriage.

(x) The carriage 70 has the space S which is adjacent to both the guide shaft 12 and the ink jet type recording unit 60, and the energizing member 77 is

- jet type recording unit (60) is mounted on said carriage (70), fastens said ink jet type recording unit (60) to said carriage (70), and when said ink jet type recording unit (60) is removed from carriage (70), unfastens said ink jet type recording unit (60) from said carriage (70), and said mounting mechanism (100) operates in association with said moving mechanism (101).
7. An ink jet type recording unit (60) especially according to any one of the preceding claims comprising: a casing (62) which can be detachably mounted on a carriage (70) and has an ink cartridge accommodating chamber (611); an ink jet type recording head (61) which, when said casing (62) is mounted on said carriage (70), is fixed at a position where said ink jet recording head (61) is confronted with a platen (41); a cartridge fixing lever (613) which is swingably provided at one end of said casing (62), to load an ink cartridge (50) in said casing (62) and unload said ink cartridge (50) from said casing (62); and a cartridge locking member (640) which, when said ink cartridge (50) is loaded in said casing (62), is normally protruded towards said ink cartridge (50) to prevent said ink cartridge (50) from coming off, and when said casing (62) is fixedly mounted on said carriage (70), is retracted so as to permit the loading and unloading of said ink cartridge (50).
 8. The ink jet type recording unit (60) according to claim 7, characterized by ink supplying needles (615, 616, 617) for supplying inks from an ink cartridge (50) to said ink jet type recording head (61).
 9. The ink jet type recording unit (60) according to claim 7 or 8, characterized by a circuit board (622) in which circuit means (630) for driving said recording head (61) is built, said circuit board (622) having contacts (635, 637) which are connected to contacts (76b) provided on a recording apparatus body, said circuit board (622) being connected through a flexible cable (623) to said recording head (61).
 10. An ink jet type recording unit (60) according to any of claims 7 to 9, in which said cartridge fixing lever (613) has protrusions (613c) on the side of the center of swing thereof which are engaged with the lower surfaces of ribs (53) formed on both sides of the upper end face (52) of said ink cartridge (50), and when said cartridge fixing lever (613) is swung downwardly, said ink cartridge (50) is pushed into said casing (62) through the lower surface of said lever (613) and when said cartridge fixing lever (613) is swung upwardly, said ink cartridge (50) is pulled out of said casing (62) with said protrusions (613c) engaged with said ribs (53).
 11. An ink jet type recording unit (60) according to any of claims 7 to 10, wherein when said cartridge fixing lever (613) has been retracted from said ink cartridge accommodating chamber (611), and said ink cartridge (50) is inserted into said casing (62) with said cartridge fixing lever (613) released, said ink cartridge (50) is supported by said cartridge fixing lever (613), and one side wall of said casing (62).
 12. An ink jet type recording unit (60) according to any of claims 8 to 11, wherein said ink cartridge (50) locking member (640) is so positioned that, when said ink cartridge (50) abuts against the upper surface thereof, said ink cartridge locking member (640) holds said ink cartridge (50) so that ink supplying outlets (55) of said ink cartridge are spaced from said ink supplying needles (615, 616, 617).
 13. An ink jet type recording unit (60) according to any of claims 7 to 12, wherein said carriage (70) is so shaped as to be able to accommodate a printing unit (60) of maximum size, and is adjusted in size so that at least the lower half of said casing (62) conforms to the configuration of an opening of said carriage (50).
 14. An ink jet type recording unit (60) according to any of claims 7 to 13, in which said ink cartridge (50) is divided into a plurality of chambers with partition walls in which a plurality of kinds of printing inks are stored, and has a recess in an outer surface thereof which is opposed to said partition wall, and said ink cartridge locking member (640) is engaged with said recess when protruded towards said ink cartridge accommodating chamber (611).
 15. An ink jet type recording unit (60) according to any of claims 7 to 14, in which said ink jet type recording head (61) is fixed to the lower surface of said casing (62) through a head casing (621), the outer periphery of which is formed into a frame (621a).
 16. An ink jet type recording unit (60) according to claim 15, in which said casing (62) has a window in a portion thereof which is confronted with said head casing (621), said ink supplying needles (615, 616, 617) are embedded in said head casing (621), and annular protrusions (618a, 619a, 620a), which are larger in inside diameter than ink supplying outlets (618), are formed around said ink supplying needles (615, 616, 617).
 17. An ink jet type recording unit (60) according to claim 15 or 16, further comprising a plurality of ribs (638)

FIG. 1

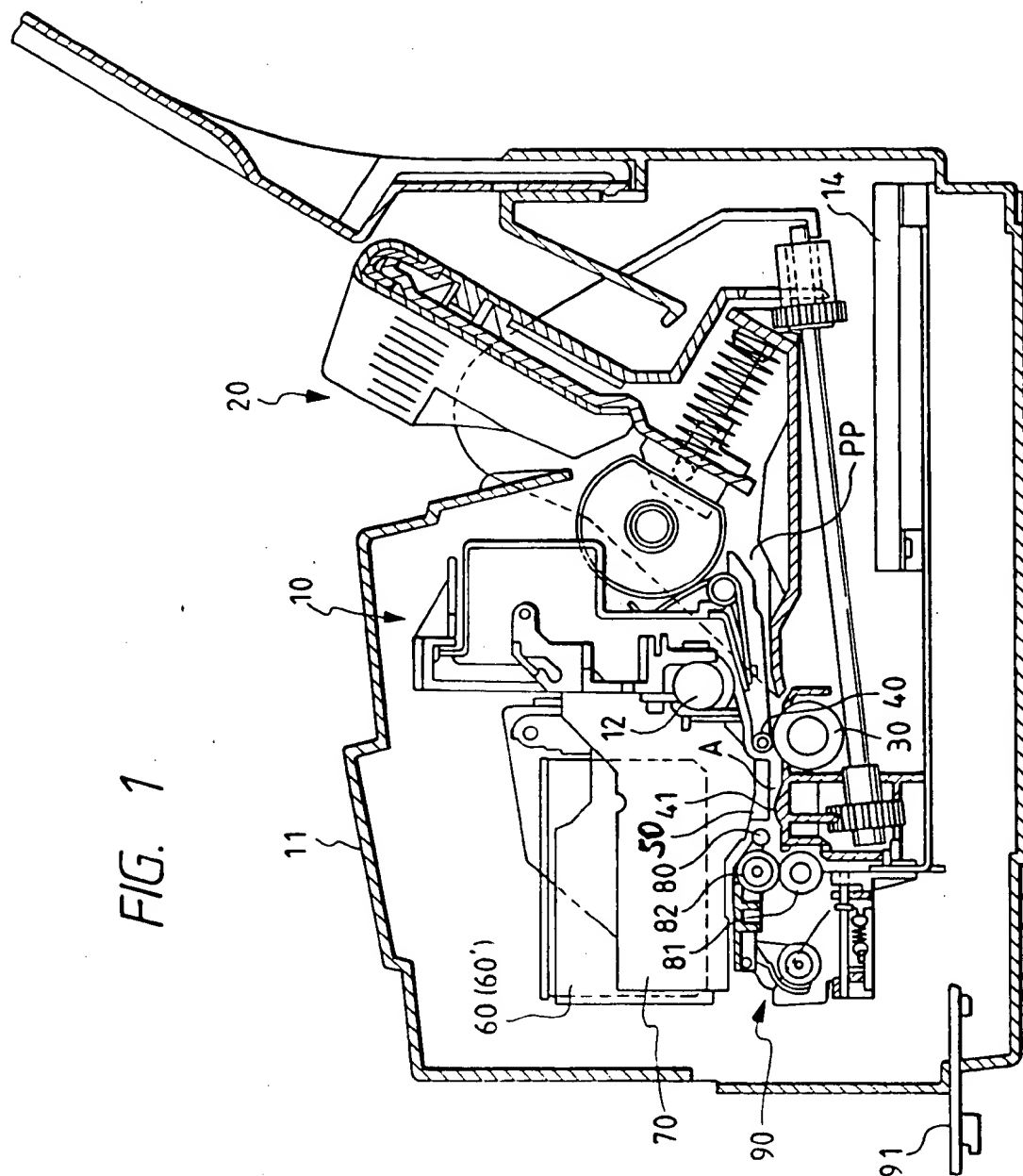


FIG. 3(a)

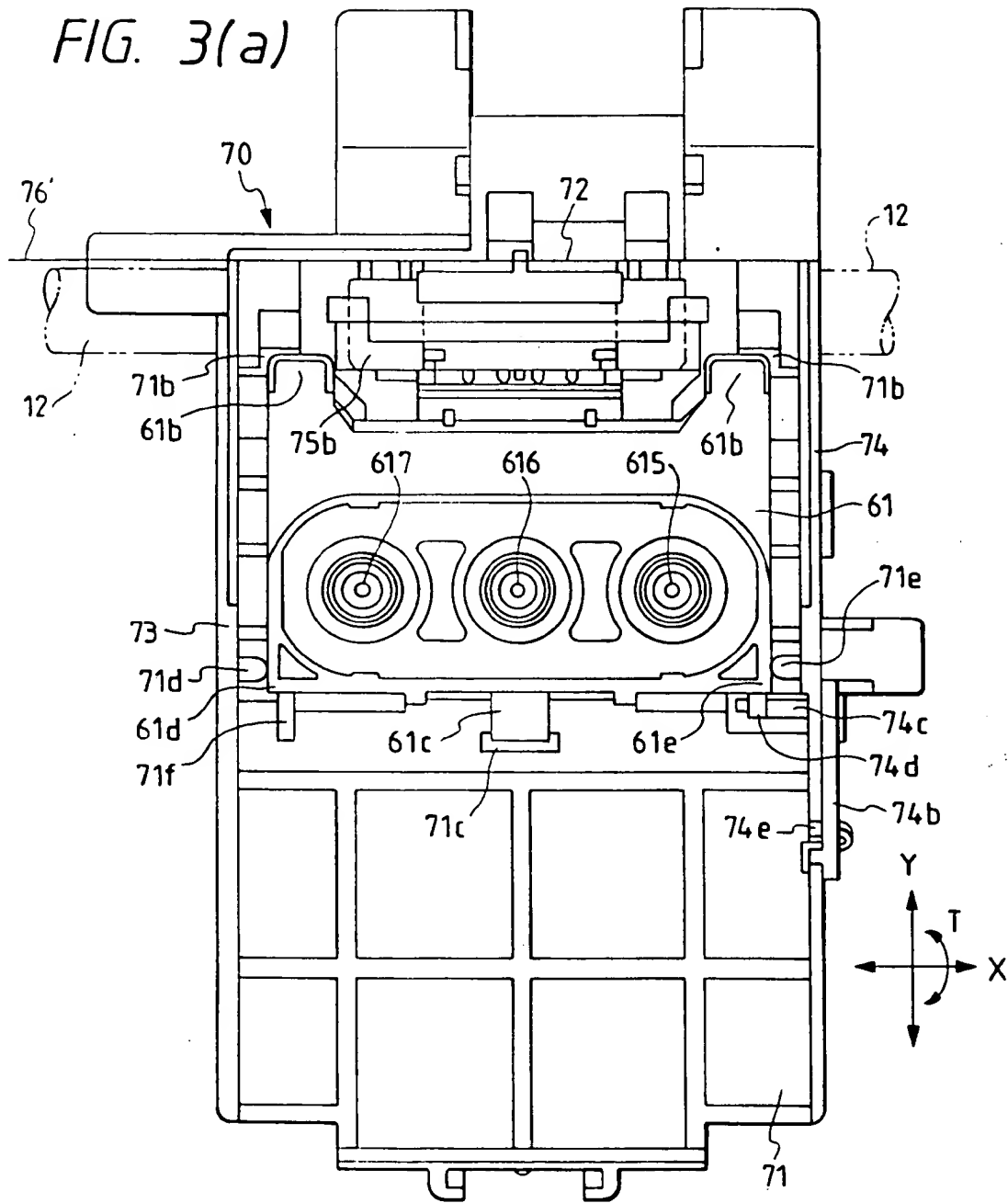


FIG. 3(b)

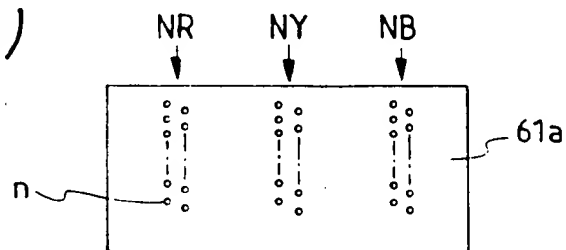


FIG. 5(a)

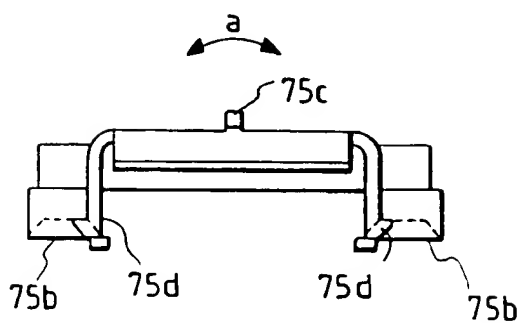


FIG. 5(b)

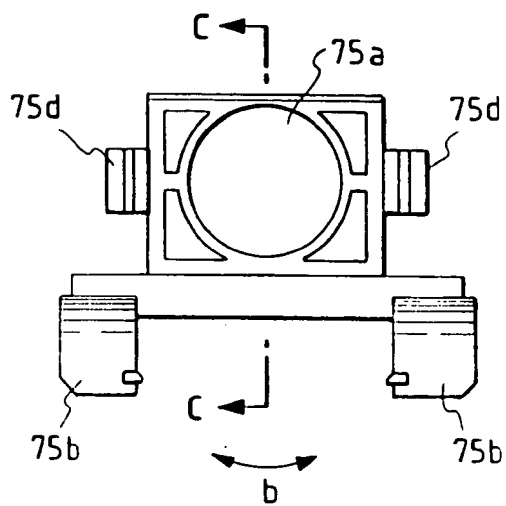


FIG. 5(c)

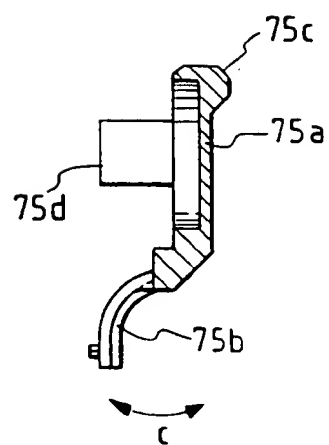


FIG. 7(a)

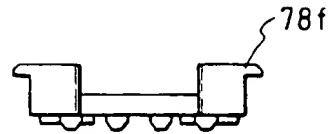


FIG. 7(b)

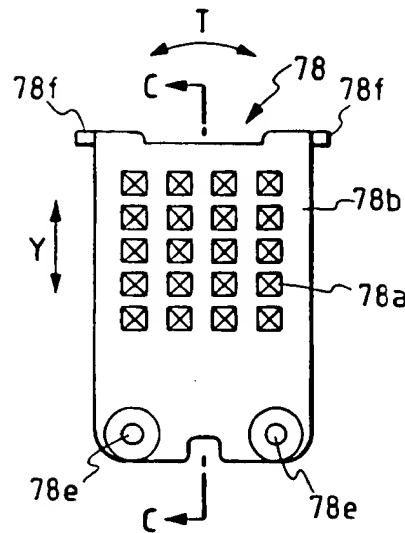


FIG. 7(c)

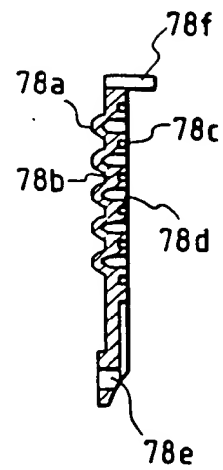


FIG. 7(d)

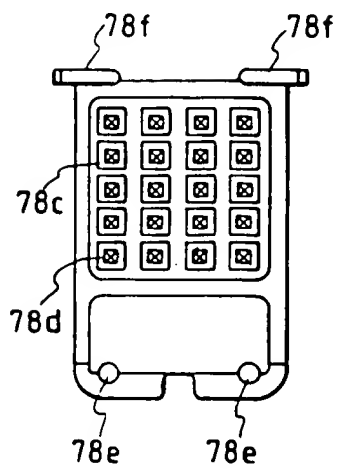
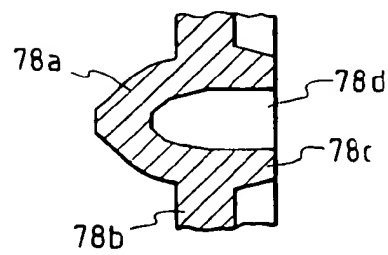


FIG. 7(e)



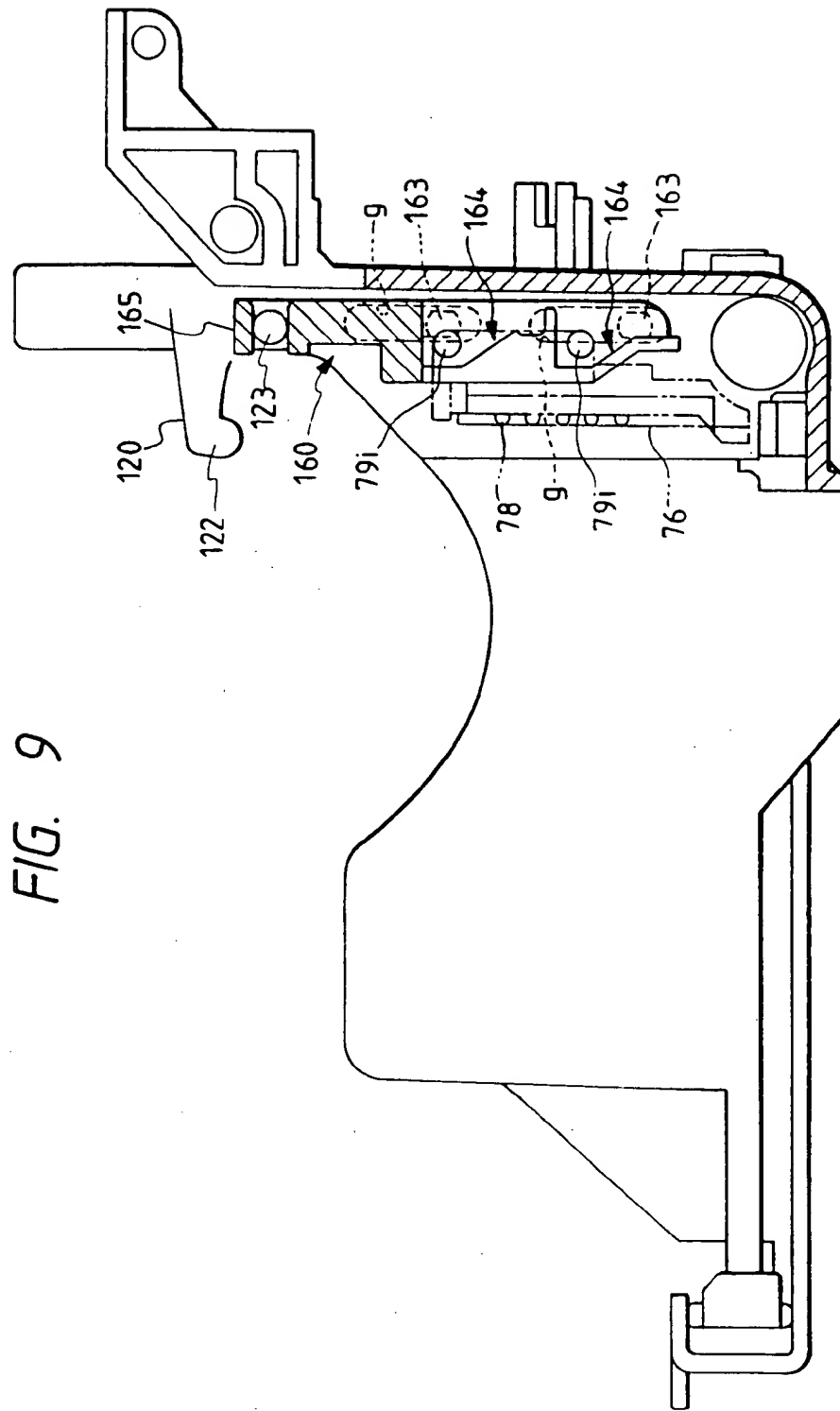


FIG. 9

FIG. 11

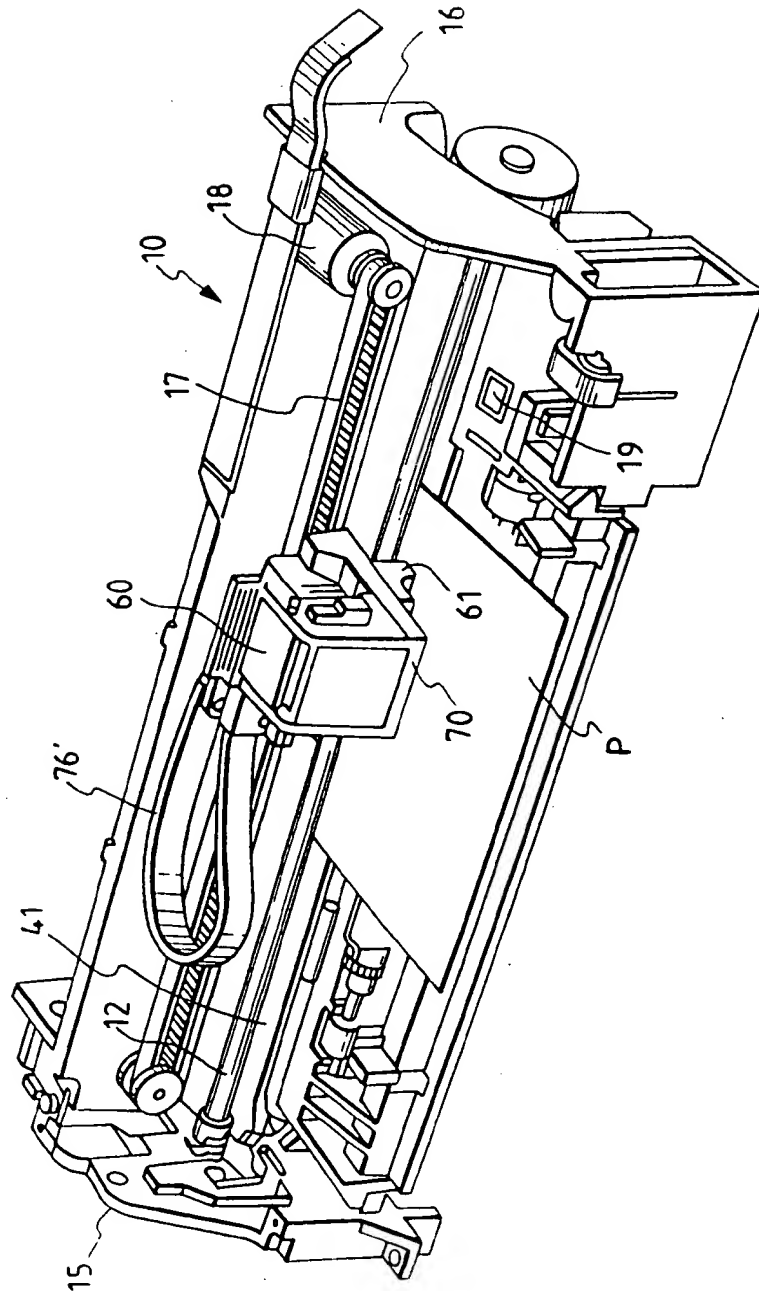


FIG. 13

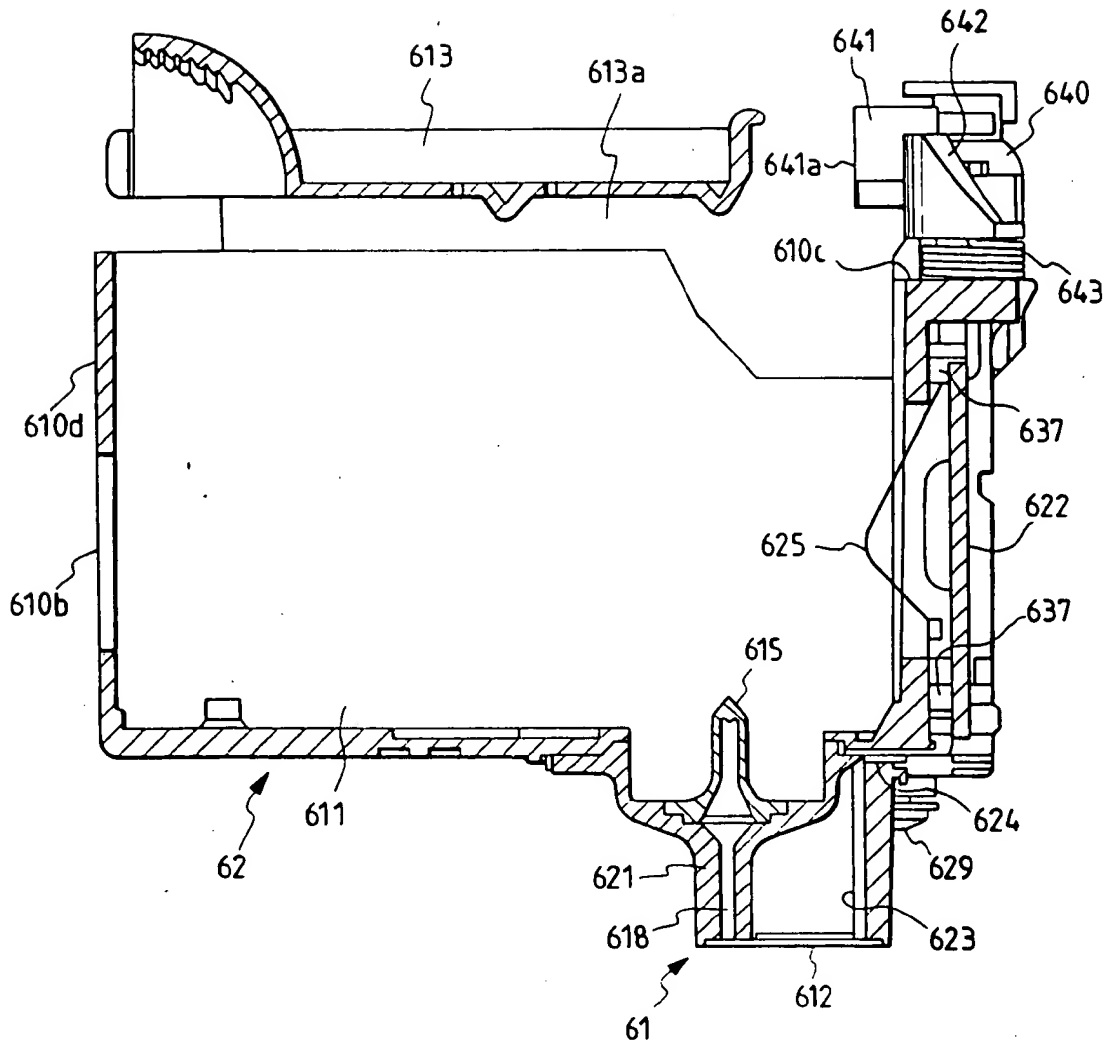


FIG. 15

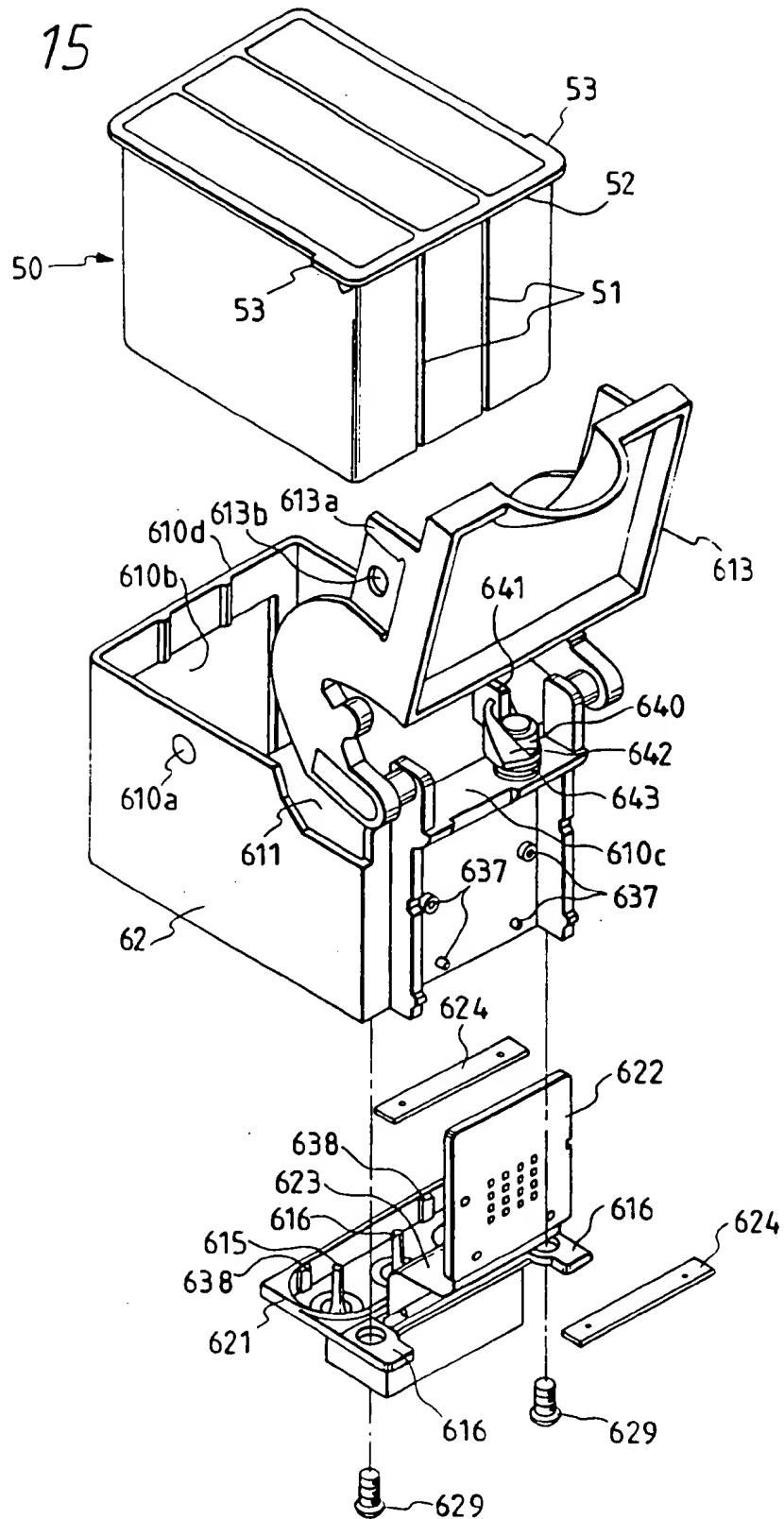


FIG. 17

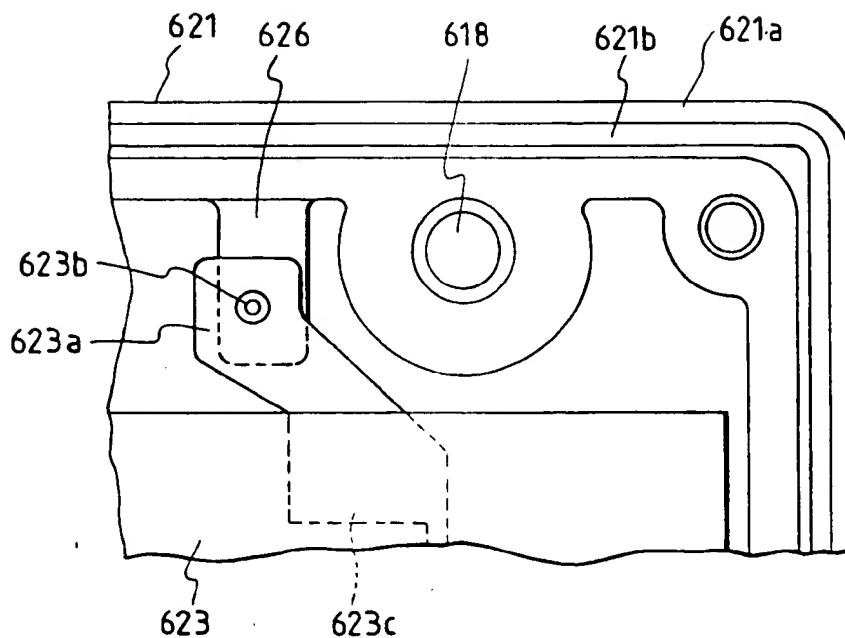


FIG. 18



FIG. 20(a)

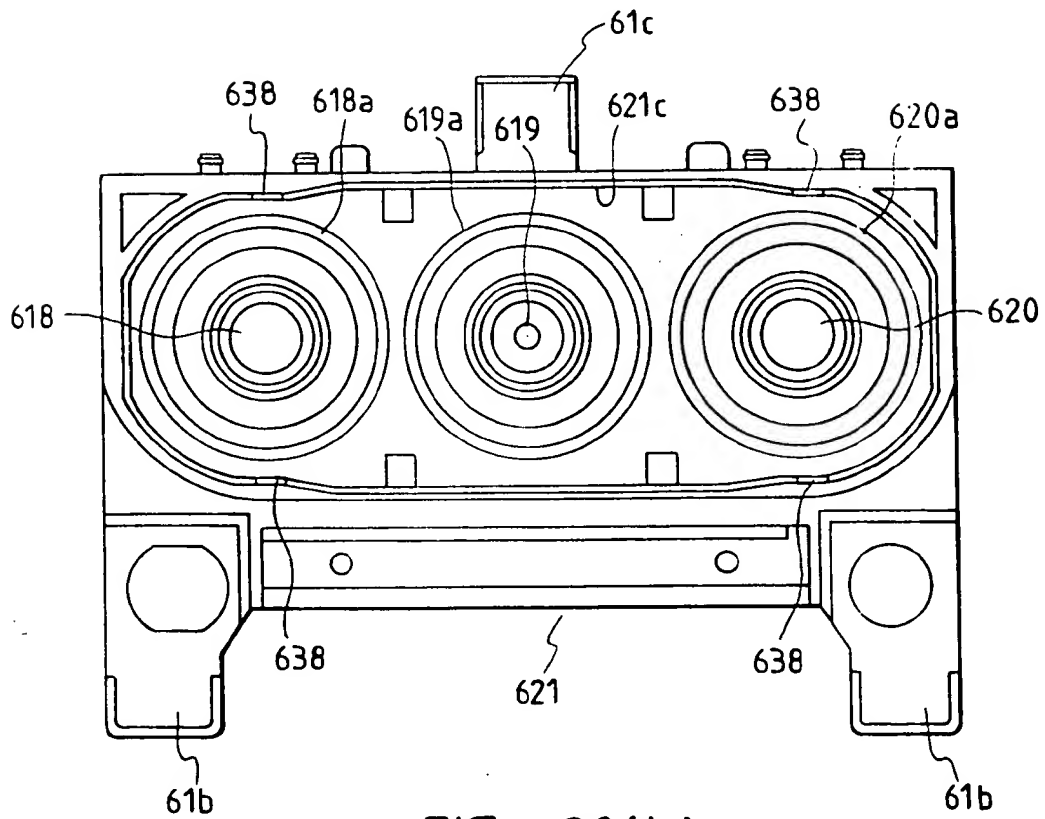


FIG. 20(b)

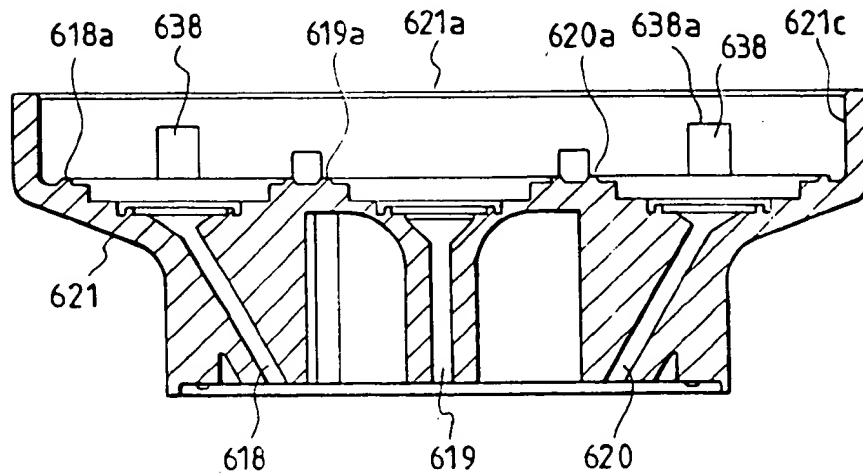


FIG. 22

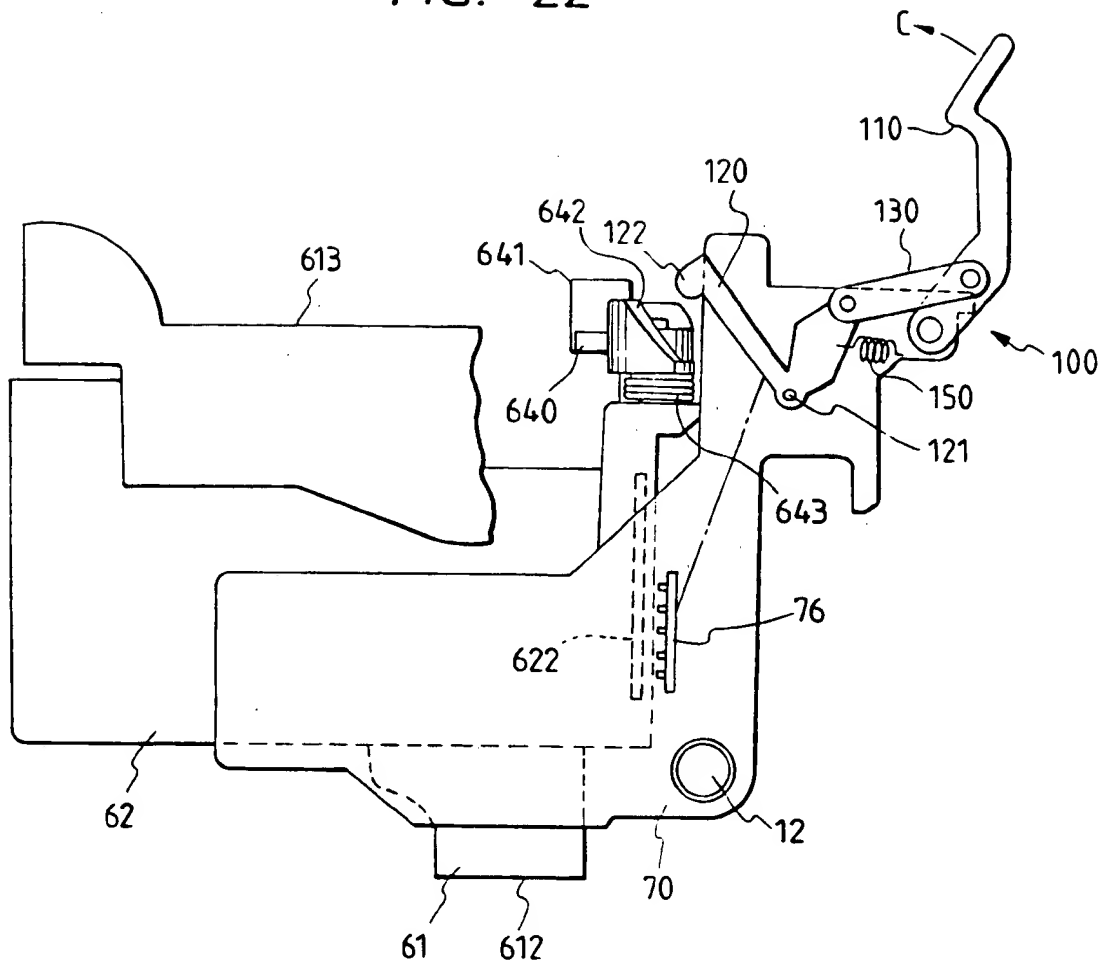


FIG. 25(a)

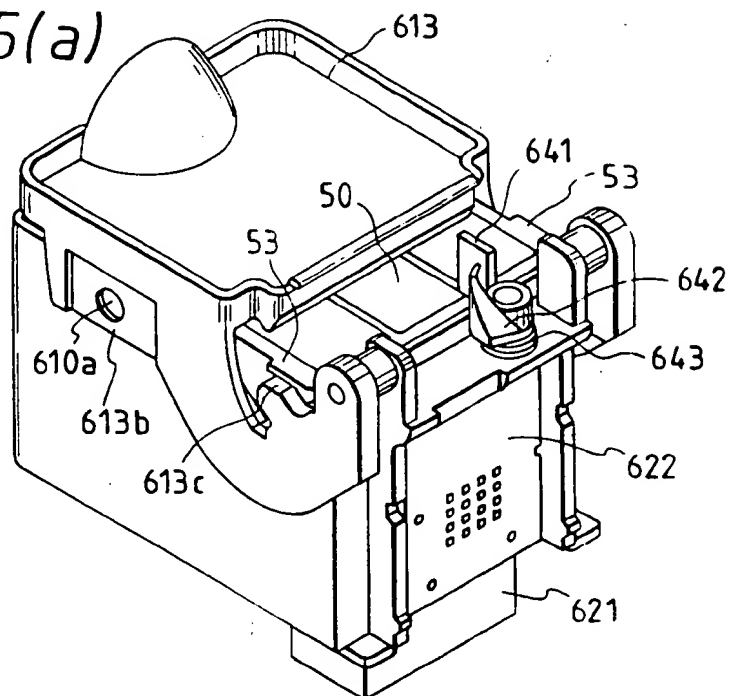


FIG. 25(b)

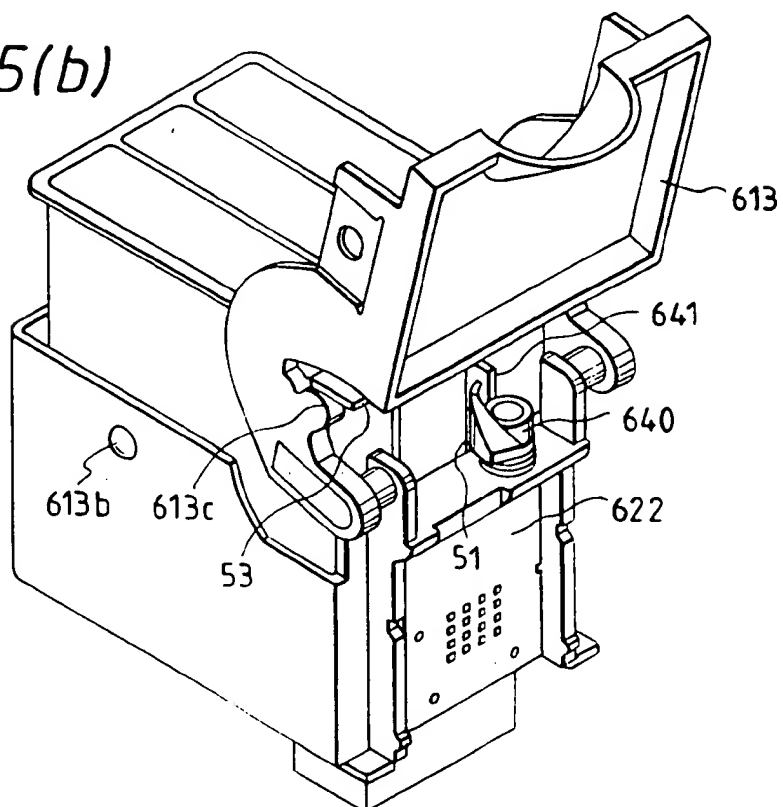


FIG. 27

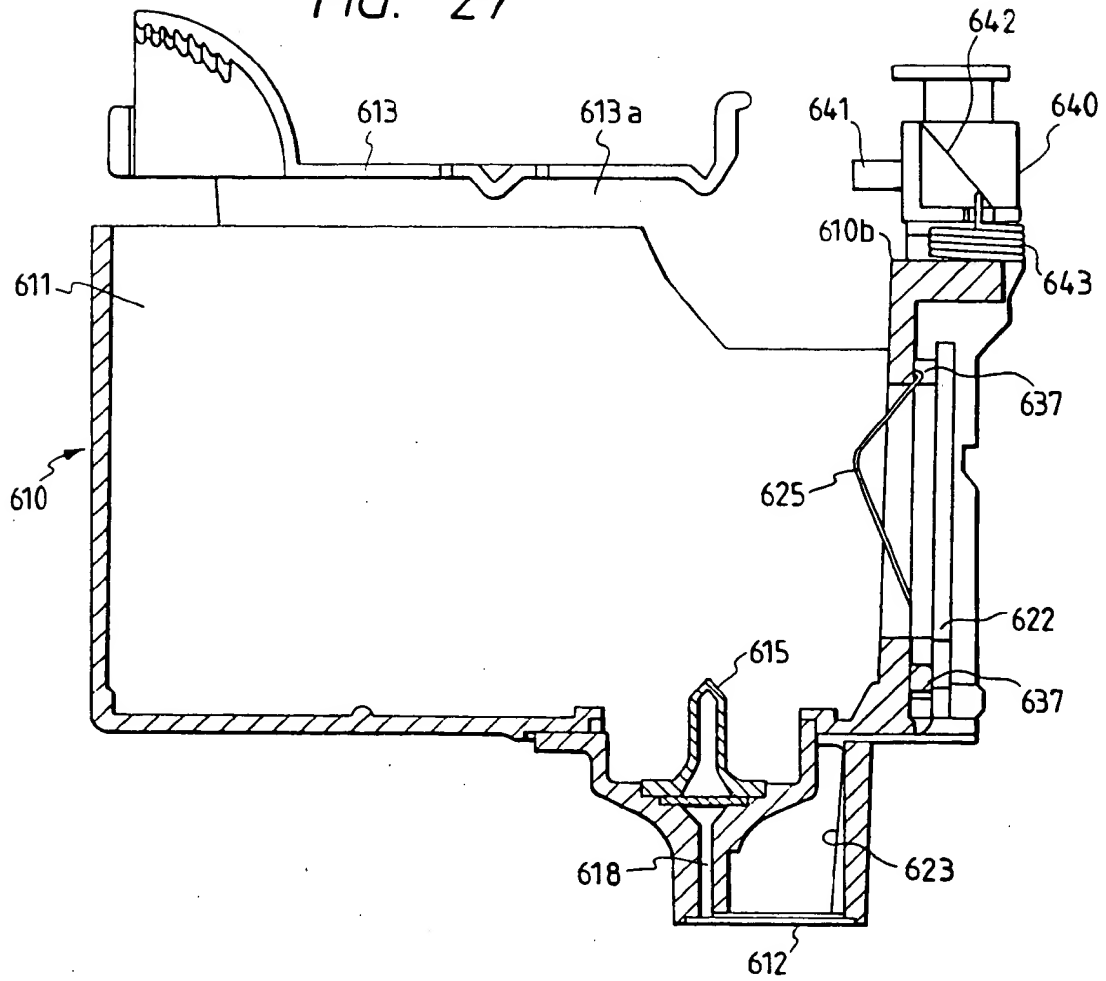
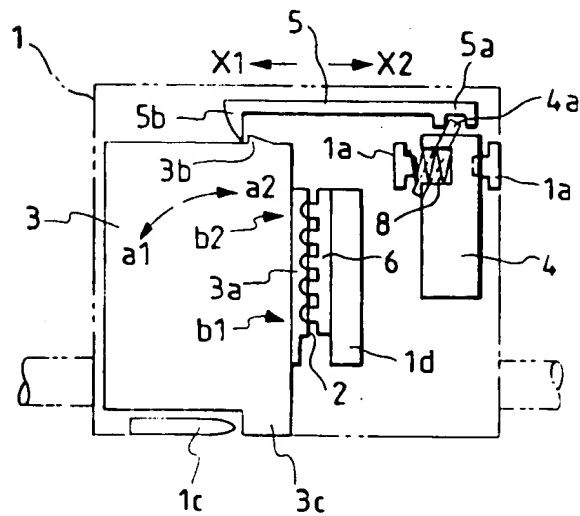


FIG. 28





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 11 7149

| DOCUMENTS CONSIDERED TO BE RELEVANT | | | |
|---|--|--|--|
| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int.Cl.6) |
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| A | EP-A-0 546 832 (CANON K.K.) * figures 2-5,22-26,80-82 * * abstract * | 1,6,7 | |
| A | EP-A-0 546 544 (CANON K.K.) * abstract; figures 1-3,9,10 * | 1,7 | |
| D,A | PATENT ABSTRACTS OF JAPAN vol. 15, no. 290 (M-1139), 23 July 1991 & JP-A-03 104643 (CANON INC.), 1 May 1991, * abstract * | 1 | |
| | | | TECHNICAL FIELDS SEARCHED (Int.Cl.6) |
| | | | B41J |
| The present search report has been drawn up for all claims | | | |
| Place of search | | Date of completion of the search | Examiner |
| BERLIN | | 24 April 1996 | Zopf, K |
| CATEGORY OF CITED DOCUMENTS | | | |
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